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EPA 180.1 – Turbidity Screen for Protozoan Laboratory

Access to this SOP shall be available within the laboratory for reference purposes; the official copy of this SOP resides on the official Georgia EPD website at https://epd.georgia.gov/about-us/epd-laboratory-operations. Printed copies of this SOP will contain a watermark indicating the copy is an uncontrolled copy.

1 Scope and Application

1.1 Turbidity testing in the protozoan laboratory is exclusively conducted on proficiency testing samples related to EPA method 1623. This method is applicable to drinking, ground, surface, and saline waters in the range of turbidity from 0 to 40 nephelometric turbidity units (NTU). Higher values may be obtained with dilution of the sample. The method is based upon a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension. The higher the intensity of scattered light, the higher the turbidity.

1.2 Restricted Procedure
This procedure is restricted to use by an analyst experienced in the operation of a Nephelometer or Turbidimeter. Additionally, the analyst must complete the requirements of the Ga EPD Initial Demonstration of Capability prior to the analysis of actual samples. Analysts are further warned that performance of this analysis involves the use of potentially hazardous chemicals; refer to the Ga EPD Chemical Hygiene Plan and Fire Safety Plan for additional information regarding chemicals required by this method (See SOP reference 13.3).

2 Definitions

2.1 Refer to Section 3 and Section 4 of the Georgia EPD Laboratory Quality Assurance Manual for Quality Control Definitions. (SOP Reference 13.2)

2.2 Primary Source (PS) – A standard that is used to make up the calibration points of a curve.

2.3 Second Source (SS) – A standard made from a manufacturer other than that of the primary source or a different lot number from the same manufacturer of the primary standard.

2.4 Initial Calibration Verification (ICV) – An ICV is a second source standard that is used to verify the correctness of the primary source calibration curve. The ICV is run at a level equal to that of the midpoint on the calibration curve.

2.5 Continuing Calibration Check (CCC) or Continuing Calibration Verification (CCV) – A standard used to verify that the response of the instrument has not changed since initial calibration.- The CCC is run at a level equal to that of the midpoint on the calibration curve.

2.6 Continuing Calibration Blank (CCB) – A volume of reagent water.

3 Interferences

3.1 The presence of floating debris and coarse sediments, which settle out rapidly, will give low readings. Finely divided air bubbles will affect the results in a positive manner.

3.2 The presence of true color, that is the color of water, which is due to, dissolved substances, which absorb light, will cause turbidities to be low, although this effect is generally not significant with finished waters.

3.2 Light absorbing materials such as activated carbon in significant concentrations can cause low readings.

4 Safety

4.1 Refer to Laboratory Chemical Hygiene Plan and Fire Safety Plan, online revision. (SOP Reference 13.3)

5 Apparatus and Equipment

5.1 Cuvettes
5.2 Turbidimeter
5.3 Wipe tissue

6 Reagents

6.1 Calibration Standards (Primary Source):
6.1.1 The calibration standards are 0.02, 10.0, and 1000 NTU.
6.1.2 The standards are certified, commercially prepared solutions that are purchased.
6.1.3 The ProCal Primary Calibration Kit, Full Range, 0.02, 10.0, and 1000 NTU is purchased from Fisher, Catalog No. 15-393-101. The HF Scientific P/N is 39957.
6.2 Initial Calibration Verification Standard (ICV):
6.2.1 ProCal 10.0 NTU Primary Turbidity Standard P/N 53000 or equivalent
6.2.2 Note: Special order from Fisher Scientific.
6.3 Continuing Calibration Check (CCC):
6.3.1 ProCal Primary Calibration standard 10 NTU from ProCal Primary Calibration kit.
6.3.2 Same source as the calibration standard.
6.4 Initial Calibration Blank (ICB) and Continuing Calibration Blank (CCB):
6.4.1 Reagent Water - Purified water which does not contain any measurable quantities of target analytes or interfering compounds for each compound of interest. (Deionized, HPLC, Milli-Q water or equivalent. Milli-Q water has a resistivity of 18.2 [MΩ.cm]@ 25°C and a TOC of 50 ug/L or less).

7 Sample Collection

7.1 Not Applicable

8 Calibration

8.1 Calibration Standards

The calibration standards consist of standards at the following concentrations: 0.02 NTU, 10 NTU, and 1000 NTU.

8.2 Calibration Curve

Not applicable.

8.3 Calibration Verification

A standard suspension of Formazin or a commercially available polymer standard is used to calibrate the instrument. An alternate source standard, the Initial Calibration Verification Standard (ICV), is used to verify initial calibration of the measurement system. The ICV value must be within 10% of its true value.

8.3.1 Initial calibrations are performed prior to sample analysis.

8.3.4 A Continuing Calibration Check (CCC) and a Continuing Calibration Blank (CCB) must be analyzed at the end of the sample run. The CCC must be within 10% of its true value. The CCB must be less than 10 NTU.

9 Quality Control

9.1 Refer to Table 14.1 for Quality Control Acceptance Criteria, and Table 14.2 for Quality Control Procedures associated with this method and Standard Operating Procedures for Control Charts and Control Limits.

10 Procedure

10.1 Remove sample bottles, standards, and reagents from cold storage and allow them to equilibrate to room temperature prior to sample preparation and/or analysis.

10.2 Turn on turbidimeter and let it warm up for at least 30 minutes.

10.3 Index all cuvettes by pouring a standard into the cuvette and rotating the cuvette in small increments. Rotate until the lowest value is found. Mark with a ring or marker. The mark and the hole in the sample well will be the indexed position.

10.4 Press the “cal” key.

10.5 The turbidity value displayed in lower row of display should read 1000. Insert the 1000 NTU standard into the sample well and rotate index mark to correct position.

10.6 Press the top arrow button when the standard is in position. After the enter key has been pressed the instrument will calibrate on the 1000 NTU level (the “store” block will flash) and upper row should display 1000 NTU. The lower row now shows the 10 NTU standard, indicating the 10 NTU standard should be placed in the sample well.

10.7 Insert the 10 NTU and calibrate the same way as the 1000 NTU.

10.8 Insert the 0.02 NTU standard and calibrate the same as the 10 NTU.

10.9 The instrument will automatically exit the calibration mode and return to the normal automatic mode.

10.10 Check the curve with the following secondary calibration standard:10NTU standard.

10.11 Shake sample; pour into a marked cuvette and line the mark up with the hole in the sample well. Record measurement. If sample is over 40 NTUs, dilute as needed with reagent water and read again. Multiply dilution factor by result.

11 Calculations

11.1 Multiply sample readings by appropriate dilution to obtain final reading.

12 Waste Management

12.1 Refer to GA EPD Laboratory SOP – EPD Laboratory Waste Management Standard Operating Procedures, SOP 6-015, online revision.

13 References

13.1 Methods for Chemical Analysis of Water and Wastes, Turbidity, Method 180.1 (Nephelometric). U.S. EPA Office of Research and Development: Cincinnati, OH, 1983, EPA 600/4-79-020, Revision 2.0 (1993).

13.2 GA EPD Laboratory Quality Assurance Plan, online revision.

13.3 GA EPD Laboratory Safety/Chemical Hygiene Plan & Fire Safety Plan, online revision.

13.4 GA EPD Laboratory SOPs – Initial Demonstration of Capability SOP 6-001, online revision and/or Continuing Demonstration of Capability SOP 6-002, online revision.

13.5 Source Water Monitoring Guidance Manual For Public Water Systems. For The Final Long Term 2 Enhanced Surface Water Treatment Rule. Office of Water EPA 815-R06-005, February 2006

14 Reporting Limits (RLs), Precision and Accuracy Criteria, and Quality Control Approach

Reporting limits are not applicable.

Table 14.1 Acceptance Criteria for Method EPA 180.1

Method	Analyte	Accuracy Water (%R)	Precision Water (RPD)
EPA 180.1	Turbidity	90-110	15

Table 14.2 Summary of Calibration and QC Procedures for Method EPA 180.1

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance criteria	Corrective Action	Flagging Criteria
EPA 180.1	Turbidity	Initial Demonstration: Demonstrate ability to generate acceptable accuracy and precision using four analysis of a QC check sample and a blank.	Once per analyst	QC Acceptance Criteria Table 14.1 and Initial demonstration SOP (Reference 13.4)	Recalculate results: locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	

Table 14.2 Summary of Calibration and QC Procedures for Method EPA 180.1

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance criteria	Corrective Action	Flagging Criteria
EPA 180.1	Turbidity	Continuing Demonstration: Demonstrate ability to generate acceptable accuracy and precision by the analysis of a QC sample(s).	Every 6 months after IDC	QC Acceptance Criteria Table 14.1 and Continuing Demonstration of Capability SOP (Reference 13.4)		
		Initial Calibration Verification (ICV)	Prior to every use	Result must be within 10% of expected value	Correct problem and repeat initial calibration	
		Initial Calibration Blank (ICB)	Once per batch	Values must be < 10	Correct problem and repeat initial calibration	
		Continuing Calibration Check (CCC)	At the end of the run	QC Acceptance Criteria Table 14.1	Correct problem and reanalyze.	
		Continuing Calibration Blank (CCB)	At the end of the run.	Value must be < 10	Correct problem and reanalyze.	

Updates to previous version:
Updated for online revision